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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/042,426 | 01/07/2002 | Hougie Dai | STFD.021 C1 (\$98-049A) | 5728 |
| 7590 11/26/2003 | | | | |
| Attention: Robert J. Crawford CRAWFORD PLLC Suite 390 1270 Northland Drive St. Paul, MN 55120 | | | | |
| EXAMINER | | | | |
| MARKHAM, WESLEY D | | | | |
| ART UNIT | | PAPER NUMBER | | |
| 1762 | | | | |

DATE MAILED: 11/26/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/042,426

Applicant(s)

DAI ET AL.

Examiner

Wesley D Markham

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 27-70 is/are pending in the application.
- 4a) Of the above claim(s) 38-69 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27-37 and 70 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet, 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet, 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. Acknowledgement is made of the amendment filed by the applicant on 9/2/2003 (with a certificate of mailing dated 8/27/2003), in which the title of the instant application was amended, a new abstract of the disclosure was submitted, and the specification was amended. Claims 27 – 70 are currently pending in U.S. Application Serial No. 10/042,426, with Claims 38 – 69 being withdrawn from consideration by the examiner pursuant to a restriction requirement, and an Office Action on the merits follows.

Election/Restrictions

2. Applicant's affirmation of the election with traverse of Group I, Claims 27 – 37 and 70, drawn to a method for manufacturing a carbon nanotube device, in the response filed on 9/2/2003, is acknowledged. The traversal is on the ground(s) that Claim 38 is a "linking claim" tying method Claims 27 – 37 and 70 (i.e., the claims of Group I) with apparatus Claims 38 – 69 (i.e., the claims of Group II), and therefore the restriction requirement must be removed and both groups of claims examined. This is not found persuasive because of the following reasons. Preliminarily, the examiner agrees that, in general, a claim to a "means" for practicing a process is a "linking claim" that must be examined with the elected invention. However, Claim 38 is not a proper "linking claim", as the claim is not a claim to a means for practicing the claimed process – alternatively, the claim is simply a "system" (i.e., apparatus) claim

in which the system comprises various "means" for performing various process steps. Therefore, the inventions of Group I and Group II are properly restrictable under MPEP 806.05(e). The applicant goes on to state that the instant invention, as set forth in the apparatus claims (e.g., Claim 38) is an apparatus that specifically forms a carbon nanotube and, therefore, does not involve or otherwise permit modification so as to practice another materially different process such as depositing a material other than a carbon nanotube. In response, the statement in the preamble of the claims that the system is "for manufacturing a carbon nanotube device" is simply a statement of intended use and is not given patentable weight in apparatus claims. Additionally, the examiner notes that the apparatus claimed by the applicant would not require modification in order to deposit a material other than a carbon nanotube. For example, in forming a nanotube by CVD, a minor amount of other forms of carbon (e.g., amorphous carbon) would also be deposited, and therefore, the apparatus as claimed can be used to both deposit a carbon nanotube and to deposit other forms of carbon. The requirement is still deemed proper and is therefore made **FINAL**. As such, this application contains Claims 38 – 69 drawn to an invention nonelected with traverse in the response filed on 9/2/2003. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Priority

3. In the response filed on 9/2/2003, the applicant amended the first line of the specification to indicate that the instant application is a continuation-in-part (i.e., instead of a continuation) of U.S. Application Serial No. 09/133,948, now USPN 6,346,189. The applicant states that this relationship was already implicitly present because the application claimed priority for "common subject matter". In response, the examiner agrees that the instant application is a CIP of U.S. Application Serial No. 09/133,948, and therefore the applicant has complied with the requirements of 35 U.S.C. 120. The benefit of an earlier filing date under 35 U.S.C. 120 is granted for the subject matter disclosed in U.S. Application Serial No. 09/133,948 (i.e., not for the subject matter newly added in the instant application).

Oath/Declaration

4. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02. The oath or declaration is defective because the specification to which the oath or declaration is directed has not been adequately (i.e., properly) identified. See MPEP § 601.01(a). Specifically, in light of the applicant's amendment of the first line of the specification to indicate that the instant application is a continuation-in-part (i.e., instead of a continuation) of U.S. Application Serial No. 09/133,948, the declaration originally submitted by the applicant, which is simply a copy of the declaration filed in U.S. Application Serial

No. 09/133,948, is defective because the specification to which the declaration is directed is not the same as the specification of the instant application (i.e., the specification has not been properly defined).

Drawings

5. The six sheets for formal drawings filed on 1/7/2002 are approved by the examiner.

Specification

6. The objections to the specification, set forth in paragraphs 11 – 13 of the previous Office Action (i.e., the non-final Office Action, paper #7, mailed on 5/27/2003), are withdrawn in light of the applicant's amendment in which an acceptable title and abstract of the disclosure were submitted, and the specification was amended to expressly align the claimed subject matter (i.e., the subject matter of Claims 34 – 35) with the body of the specification. However, the examiner disagrees with the applicant's statement on page 14 of the response filed on 9/2/2003, in which the applicant states that the detailed description addresses the subject matter of Claim 34 at the last sentence of page 8 and extending to page 9, line 1. This section of the detailed description simply states that a carbon feedstock gas can be reacted using a catalyst for growing carbon nanotubes. This in no way supports Claim 34, which requires contacting the catalyst island with a carbon containing gas that has been reacted using a catalyst.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. The rejection of Claims 37 and 70 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement for containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention, set forth in paragraph 15 of the previous Office Action, is maintained.
9. Regarding this issue, the applicant's arguments have been fully considered but are not persuasive. First, the applicant argues that the "combination of steps" presented in Claims 37 and 70 is clearly described in the specification because the claim language is part of the specification. In response, the examiner agrees that the claims are a part of the specification. However, Claims 37 and 70 were introduced in preliminary amendment C, which was filed on 3/19/2003, after the filing of the instant application. Therefore, Claims 37 and 70 were not part of the specification as originally filed. Second, the applicant points to various portions of the specification (i.e., page 6 and the description of Figure 9) for support of Claims 37 and 70. However, after thoroughly reviewing the aforementioned portions of the specification, the examiner maintains that the subject matter claimed in Claims 37 and 70 was not described in the specification in such a way as to reasonably convey

to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. For example, while page 6 of the specification as originally filed discloses that the substrate may include silicon, alumina, quartz, silicon oxide, or silicon nitride, and may include a metal film on the top surface, the specification does not more broadly describe or disclose an insulative substrate with a layer of conductive material thereon, as recited in Claims 37 and 70. The original disclosure of a few species of insulative substrates (e.g., alumina, quartz, silicon oxide, etc.) and a single species of conductive material (i.e., a metal film) is not sufficient to convey to one skilled in the art that the applicant had possession of the broader genus of an insulative substrate with a layer of conductive material thereon, at the time the application was filed. Additionally, while page 12 of the specification discloses that an etched trench region is formed in the substrate between catalyst islands, there is no disclosure that the etching step exposes the insulative substrate at the bottom of the trench, as required by Claim 37. Regarding Claim 70, there is no disclosure that the method can further comprise etching a trench in the exposed insulative substrate.

10. The rejection of Claim 28 under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement, set forth in paragraph 16 of the previous Office Action, is maintained.
11. Regarding this issue, the applicant's arguments have been fully considered but are not persuasive. Specifically, the applicant argues that, from the discussion of Figures

13A – 13D, it would be appreciated that the “contacting...” and “applying...” steps of Claim 28 could occur concurrently. While this may be the case, the applicant’s specification only describes contacting the free end of the cantilever to a particle of iron nitrate disposed on an electrically conductive substrate, and applying an electric field between the free end and the substrate and reacting the nitrate to form a iron oxide catalyst. Regardless of whether the aforementioned steps are carried out sequentially or concurrently, one skilled in the art would not be enabled to use the claimed invention (e.g., how would one react the claimed oxide particle to form a catalyst, as the applicant’s specification only describes reacting a nitrate particle to form an oxide catalyst particle?). There is no discussion at all about how to react an oxide particle to form a catalyst, either while contacting the free end of a cantilever to the oxide particle or after contacting the free end of a cantilever to the oxide particle.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

13. Claims 29 – 32 are rejected under 35 U.S.C. 102(b) as being anticipated by Li et al.

("Large-Scale Synthesis of Aligned Carbon Nanotubes", 1996) as set forth in paragraphs 19 – 20 of the previous Office Action.

14. Claims 29 – 31, 34, and 35 are rejected under 35 U.S.C. 102(e) as being anticipated

by Kennel (USPN 6,156,256) as set forth in paragraphs 21 – 22 of the previous Office Action.

15. Claims 29 – 32 are rejected under 35 U.S.C. 102(e) as being anticipated by Xu et al.

(USPN 5,872,422) as set forth in paragraphs 23 – 24 of the previous Office Action.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order

for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

18. Claims 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (USPN 5,872,422) in view of Kennel (USPN 6,156,256) as set forth in paragraphs 27 – 28 of the previous Office Action.

19. Claims 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (USPN 5,872,422) in view of Samsung (EP 1 134 304 A2) as set forth in paragraphs 29 – 30 of the previous Office Action.

20. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (USPN 5,872,422) as set forth in paragraphs 31 – 32 of the previous Office Action.

Double Patenting / Terminal Disclaimer

21. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);

and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969). A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b). Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

22. Claims 27 – 33 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 38 – 40 and 42 of U.S. Patent No. 6,346,189 as set forth in paragraph 36 of the previous Office Action. Specifically, the terminal disclaimer filed on 9/2/2003 disclaiming the terminal portion of any patent granted on this application that would extend beyond the expiration date of USPN 6,346,189 has been reviewed and is NOT accepted. The person who signed the terminal disclaimer (i.e., Mr. Robert Crawford) is not recognized as an officer of the assignee, and he/she has not been established as being authorized to act on behalf of the assignee. See MPEP § 324. An attorney or agent, not of record, is not authorized to sign a terminal disclaimer in the capacity as an attorney or agent acting in a representative capacity as provided by 37 CFR 1.34 (a). See 37 CFR 1.321(b) and/or (c). In the instant application, Mr. Robert Crawford does not appear to be an attorney officially of record.

23. The provisional obviousness-type double patenting rejections based on U.S.

Application Serial Nos. 10/233,320, 10/285,304, and 10/299,945, set forth in paragraphs 37 – 39 of the previous Office Action, are maintained.

24. The issue raised by the examiner in paragraphs 40 – 41 of the previous Office

Action is moot in light of the applicant's statement that the applications were all commonly owned by the same assignee at the time of the invention of this application.

Response to Arguments

25. Applicant's arguments filed on 9/2/2003 have been fully considered but they are not persuasive.

26. First and regarding the Li et al. reference, the applicant argues that Li et al. teach that the iron oxide (i.e., catalyst) particles are embedded in the pores of a silica substrate and therefore do not qualify as "islands", which is a term used by the applicant to be consistent with its normal and expected meaning in the fields of nanoprocessing, to refer to an isolated particle accessible from surrounding sites. The applicant argues that the examiner has misinterpreted the iron / iron oxide particles of Li et al. (i.e., isolated particles not accessible from surrounding sites) as islands. For support of this position, the applicant cites various other U.S. patents which use the term "island" in a manner consistent with the applicant's argument. In response, the examiner notes that the term "island" is not described or defined by

the applicant in the specification to be “an isolated particle accessible from surrounding sites”. Additionally, none of the references cited by the applicant define an island to be “an isolated particle accessible from surrounding sites”. Further, while the references cited by the applicant may refer to “islands” in general, they do not refer to catalyst islands in the field of growing carbon nanotubes and therefore are not directly on point. The examiner also notes that, even if one was to define an “island” in the manner argued by the applicant, Li et al. would still meet the limitations of the applicant’s claims. For example, even though the iron / iron oxide nanoparticles may be embedded in cylindrical pores, the nanoparticles would still be accessible from surrounding sites by traveling through the pores in which the nanoparticles are embedded. Additionally and importantly, Li et al. teaches that the carbon nanotubes also grow from the iron nanoparticles exposed on the surface of the substrate (see Figure 4 and its corresponding description). These nanoparticles would clearly be accessible from surrounding sites and therefore qualify as “islands” under the definition argued by the applicant.

27. Second and regarding the rejections based on the Xu et al. and Kennel references, the applicant argues that it is now well-accepted that carbon nanotubes are not the same as carbon fibers, and that neither Xu et al. nor Kennel teaches forming carbon nanotubes. For support, the applicant cites a Dresselhaus reference that contrasts the properties of carbon nanotubes and carbon fibers. In response, the examiner notes that the applicant’s specification (and therefore the terms utilized therein) is to be interpreted based on the time the application was filed (in this case, on

8/14/1998). As such, the Dresselhaus reference that contrasts the properties of carbon nanotubes and carbon fibers and was published in 2001 is not directly on point. Additionally, while the examiner agrees that not all carbon fibers are carbon nanotubes, both Xu et al. and Kennel teach (or, at the very least, reasonably suggest) that their methods form carbon nanotubes. For example, the carbon fibers taught by Xu et al. include single-wall or multiple-walled tubular structures that have diameters in the nanometer range (Col.9, lines 31 – 54). A single-wall tubular carbon structure with a diameter in the nanometer range is clearly a carbon nanotube. Kennel specifically describes carbon nanotubes as structures that consist of a sheet of carbon atoms in graphene form wrapped into a cylinder (Col.1, lines 31 – 36). Then, Kennel states that, “The present invention provides a method for making carbon nanofibers and nanotubes...” (Col.1, lines 52 – 53). Thus, both Xu et al. and Kennel teach depositing carbon nanotubes as required by the applicant’s claims.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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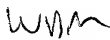
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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

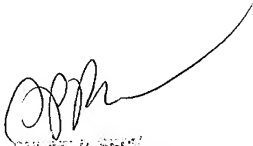
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.


WDM

Wesley D Markham
Examiner
Art Unit 1762


SHRIVE P. BECK
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700